Forest Health Protection
Pacific Southwest Region

Date: December 6, 2007
File Code: 3420

To: District Ranger, Hat Creek Ranger District, Lassen National Forest

Subject: Evaluation of Mountain Pine Beetle Activity in Lodgepole Pine Stands within the Redlock Thinning Project (FHP Report NE07-06)

At the request of Matt Staudacher, Silviculturist, Hat Creek Ranger District, I visited lodgepole pine stands near Grayback Ridge and Bunchgrass Valley on August 21, 2007. The objective was to evaluate the current mountain pine beetle (*Dendroctonus ponderosae*) activity and to evaluate the potential for future bark beetle caused tree mortality and the effectiveness of treatment alternatives. These recommendations will assist with the development of silvicultural prescriptions for these stands. Matt Staudacher, Naomi Brown, Mary Price, Paul White and Alissa Tanner accompanied me in the field.

Background

The Grayback Ridge and Bunchgrass Valley areas are located about 10 miles west of Old Station, CA, and north of Highway 44 (T32N, R3E and R4E). The elevation ranges from 5200-6000 feet and annual precipitation for the area is approximately 50 inches. Most stands are a mix of lodgepole pine (*Pinus contorta var. murrayana*), red fir (*Abies magnifica*) and white fir (*Abies concolor*), are at least 80 years old and stocked at an average basal area of 200 sq.ft./acre. Management objectives for the site include the desire to limit further mountain pine beetle caused tree mortality, capture the economic value of bark beetle killed trees and to reduce stocking and fuel loads.

Observations

Mountain pine beetle is attacking and killing larger lodgepole pine (> 8" DBH) at various levels throughout the area covering several hundred acres. Mortality has been increasing for at least a couple of years and mountain pine beetle populations in some parts of the area are now

NORTHEASTERN CALIFORNIA SHARED SERVICE AREA
2550 RIVERSIDE DRIVE
SUSANVILLE, CA 96130
530-257-2151

Daniel Cluck
Entomologist
dcluck@fs.fed.us

Bill Woodruff
Plant Pathologist
wwoodruff@fs.fed.us

approaching or are currently at epidemic levels. Aerial mortality surveys conducted in September of 2007 highlighted approximately 530 acres of lodgepole pine in this area with elevated levels mortality averaging 3 to 6 trees per acre. This survey did not include the green infested trees that will fade by next spring/summer.

Cytospora canker (*Cytospora abietis*) was observed causing extensive branch flagging of red fir.

A low level of fir engraver beetle (*Scolytus ventralis*) activity was observed in both white and red fir causing whole tree mortality.

Discussion and Recommendations

Forest Health Protection aerial and ground surveys have shown a dramatic increase in mountain pine beetle caused lodgepole pine mortality throughout northeastern California over the last 3 years. Many lodgepole pine stands have now reached maturity making them highly susceptible to mountain pine beetle attacks, especially during extended periods of warm and dry weather. Lodgepole pine trees typically become susceptible to mountain pine beetle attacks when they are over 80 years of age and 8 inches or greater in diameter. This is due to the mountain pine beetle's preference for larger trees with greater phloem thickness. High stand density also plays a role in susceptibility but to a lesser degree than with other bark beetle/host tree interactions. Regardless of the bark beetle/host tree combination, drought is the trigger for nearly all large scale bark beetle activity in California. The current extremely dry conditions combined with dense stands of larger diameter trees have created ideal conditions for localized mountain pine beetle outbreaks (refer to Appendix A for information on mountain pine beetle biology)

Lodgepole pine stands within the Redlock Project area are in a similar, highly susceptible condition. Older dead trees and recently fading trees reveal that mountain pine beetle activity has been occurring for at least two years. Furthermore, the current level of green infested lodgepole in this area suggests that this activity will continue and likely increase through next summer with many more trees > 8" DBH being attacked and killed. At this stage of a mountain pine beetle epidemic, viable management options for reducing future mortality are extremely limited.

Treatment Alternatives

Do nothing: The no management alternative would allow the mountain pine beetle epidemic to continue until all suitable host material, i.e. large diameter lodgepole pine, is killed or other environmental factors reduce beetle populations. A residual stand of white and red fir and smaller diameter lodgepole pine would remain and be at a low risk for future bark beetle activity in areas where stocking levels are sufficiently reduced. However, this alternative would also allow the extremely high fuel loads associated with the recent and imminent mortality to remain on site creating the potential for catastrophic wildfire that would consume any residual conifers and potentially spread to adjacent stands.

Salvage harvesting of dead trees: The removal of dead trees would reduce much of the fuel loading and capture some of the economic value but would not have any effect on the current beetle population as these trees are no longer suitable host material. Green infested trees would still remain on site allowing beetles to emerge next summer to attack any suitable residuals. This

activity will create additional mortality over at least the next two years that may require additional salvage operations to meet fuels objectives.

Salvage and sanitation harvest: The removal of dead trees combined with the removal of green infested and other high risk trees such as larger diameter trees with dwarf mistletoe infections, western gall rust (*Peridermium harknessii*) or other pathogens will capture most of the economic value, substantially reduce fuel loadings and may reduce the mountain pine beetle population providing that ALL green infested trees are removed prior to beetle emergence over the entire area and that the residual stocking increases tree health and vigor. In order to reduce the number of trees attacked next year, it would require that harvest activities take place prior to May/June of 2008. All lodgepole stands would then have to be continuously monitored to locate and promptly remove any green infested trees that show up after the initial treatment. Implementing this treatment before beetle flight in spring of 2008 could prove to be very difficult due to the inherent time constraints of the NEPA process. If harvest activities minimize damage to residual trees and existing regeneration, a stand of scattered white and red fir and mostly small diameter lodgepole would remain and be at a relatively low risk for future bark beetle activity and stand replacing wildfire providing stocking levels are appropriate for the site. This treatment does not guarantee that additional bark beetle activity and subsequent tree mortality will not occur over the next couple of years. In addition, wind throw of the some of the larger residual lodgepole pine should also be anticipated post treatment. (refer to Appendix B for salvage marking guidelines for dead and dying lodgepole pine)

Green tree thinning: In general, thinning pure lodgepole pine stands down to at least 80 sq.ft./acre can reduce their susceptibility to bark beetle attacks. Mixed stands of lodgepole and true fir may be able to maintain somewhat higher stocking levels. This type of treatment is more effective when residual lodgepole trees are smaller in diameter and includes the removal of individual trees that are currently infested with bark beetles, are heavily infected with dwarf mistletoe or are infected by other pathogens. It should be noted that reducing the basal area in extremely dense stands in one entry can result in wind throw and/or snow breakage of residual trees, therefore, desired stocking levels in pure lodgepole pine stands may be best achieved through multiple entries over time. Also, because older and larger diameter trees are preferred by mountain pine beetle, the thinning of lodgepole pine stands by simply removing the smaller diameter trees may not reduce mortality over the long-term. Therefore, some areas should be managed for periodic regeneration either through group selection harvests or prescribed fire before the entire stand reaches a highly susceptible age and size class.

As with the salvage and sanitation harvest option, thinning trees in the Redlock Project may not result in lower mortality levels unless the entire lodgepole area could be treated, with all green infested and high risk trees removed, before beetle emergence next spring/summer. Follow up treatments that promptly remove green infested trees would then be required until beetle activity subsides.

If salvage and sanitation or green tree thinning activities are not completed before May/June of 2008, more lodgepole can be expected to be attacked with subsequent mortality showing up by the end of next summer and into the spring/summer of 2009. Any treatment options occurring after May/June of 2008 should anticipate additional volume of green infested and/or dead trees and any chance of reducing mountain pine beetle caused mortality will be delayed until the following year.

Forest Health Protection may be able to assist with funding for thinning and removing green material from overstocked areas on the Lassen National Forest on a competitive basis. If you are interested in this funding please contact any of the Forest Health Protection staff for assistance in developing and submitting a proposal.

If you have any questions regarding this report and/or need additional information please contact me at 530-252-6431 or dcluck@fs.fed.us.

/s/ Danny Cluck

Daniel R. Cluck
Entomologist
NE CA Shared Services Area

cc: Matt Staudacher, Hat Creek RD
Johanna D'Arcy, Hat Creek RD
Dave Evans, Lassen SO
Forest Health Protection, Regional Office

Appendix A – Insect Information

Mountain pine beetle

The mountain pine beetle, *Dendroctonus ponderosae*, attacks the bole of ponderosa, lodgepole, sugar and western white pines larger than about 8 inches dbh. Extensive infestations have occurred in mature lodgepole pine forests. Group killing often occurs in mature forests and young overstocked stands of ponderosa, sugar and western white pines.

Evidence of Attack

The first sign of beetle-caused mortality is generally discolored foliage. The mountain pine beetle begins attacking most pine species on the lower 15 feet of the bole. Examination of infested trees usually reveals the presence of pitch tubes. Pitch tubes on successfully infested trees are pink to dark red masses of resin mixed with boring dust. Creamy, white pitch tubes indicate that the tree was able to "pitch out" the beetle and the attack was not successful. In addition to pitch tubes, successfully infested trees will have dry boring dust in the bark crevices and around the base of the tree. Attacking beetles carry the spores of blue-staining fungi which develop and spread throughout the sapwood interrupting the flow of water to the crown. The fungi also reduces the flow of pitch in the tree, thus aiding the beetles in overcoming the tree. The combined action of both beetles and fungi causes the needles to discolor and the tree to die.

Life Stages and Development

The beetle develops through four stages: egg, larva, pupa and adult. The life cycle of the mountain pine beetle varies considerably over its range. One generation per year is typical, with attacks occurring from late June through August. Two generations per year may develop in low elevation sugar pine. Females making their first attacks release aggregating pheromones. These pheromones attract males and other females until a mass attack overcomes the tree. The adults bore long, vertical, egg galleries and lay eggs in niches along the sides of the gallery. The larvae feed in mines perpendicular to the main gallery and construct small pupal cells at the end of these mines where they pupate and transform into adults.

Conditions Affecting Outbreaks

The food supply regulates populations of the beetle. In lodgepole pine, it appears that the beetles select larger trees with thick phloem, however the relationship between beetle populations and phloem thickness in other hosts has not been established. A copious pitch flow from the pines can prevent successful attack. The number of beetles, the characteristics of the tree, and the weather affect the tree's ability to produce enough resin to resist attack. Other factors affecting the abundance of the mountain pine beetle include nematodes, woodpeckers, and predaceous and parasitic insects. As stand susceptibility to the beetle increases because of age, overstocking, diseases or drought, the effectiveness of natural control decreases and pine mortality increases.

Appendix B – Salvage Marking Guidelines

Lodgepole Pine (all size classes)

Trees meeting one or more of the following guidelines will be considered "dying." For consistency with other marking guidelines and definitions, trees with full crown fade will be designated as "dead."

Active Crown Fade

At least 50% of the live crown exhibiting current, active, contiguous, crown fade or dieback from the top or throughout the upper crown. Specifically excludes older top-kill with very few or no needles remaining. Also excludes fading of older needles associated with excessive needle cast.

Pitch Tubes

Pink to reddish pitch tubes are numerous (>10), and are found over at least 50% of the circumference of the bole, at or above 5 feet, and extending at least 10 to 15 additional feet up the bole. Specifically excludes whitish pitch tubes that do not have pink or reddish boring dust associated with them.

The pitch tube criteria specifically excludes basal attacks by the red turpentine beetle (RTB) which are characterized by very large pitch tubes, associated with coarse boring dust, generally restricted to the lower 2 to 3 feet of the bole. However, RTB attacks are not common in lodgepole pine.

Boring dust or frass, pouch fungus conks and/or woodpecker activity

Any combination of boring dust or frass (in bark crevices, webbing along the bole, or that accumulates at the base of the trees), pouch fungus conks and/or woodpecker activity (holes into the sapwood and/or bark flaking, specifically excludes injury caused by sapsucker feeding) present over at least 1/3 of the bole circumference. Specifically excludes these indicators when only associated with wounds, old fire scars, etc.